**Entomology and Applied Science Letters**
**Volume 11, Issue 4, Page No: 9-15**

Available Online at: www.easletters.com

**ISSN No: 2349-2864**

# Efficacy of New Chemical Insecticides against Cabbage Aphids, *Brevicoryne brassicae* L. (Aphididae: Homoptera) in West Shoa of Ethiopia

**Tadele Shiberu[1]***

*[1]Department of Plant Science, School of Agriculture, Guder Mamo Mezemir Campus, Ambo University, Ethiopia.*

**ABSTRACT**

Cabbage is Ethiopia's second most important vegetable crop in production next to red pepper. It is a widely grown vegetable throughout the world. A synthetic insecticide Dedu Star 35% SC and Range 5% EC insecticides was tested under field conditions at three different locations. The experiment was laid out in a Randomized Complete Block Design with three replications on farmers' fields to evaluate the performance of newly introduced insecticide to control Cabbage aphids in Cabbage crops. The effect of two insecticides in three different rates on the percent mortality of *Brevicoryne brassicae* was assessed at West Shoa on farmers' fields at Ambo, Toke Kutaye, and Ejersa lafo districts from January 2021 to May 2021. Closer 240 SC (Sulfoxaflor) and water were included as a standard check and untreated control. At all locations, the highest rate of Dedustar was 35% SC (225 ml/ha), and Range 5% EC (375 ml/ha) showed high mortality rates and a low number of aphid infestations. The best treatment was 99.13, 98.2,5%, and 96.13% mortality at Ambo, Toke kutaye, and Ejersa lafo, respectively. The yield loss recorded in the control treatment was 61.37, 64.01, and 52.32 at Ambo, Toke kutaye, and Ejersa lafo, respectively. From the experiments, it can be concluded that both new insecticides Dedustar 35% SC and Range 5% EC at a maximum rate compatible with the management of cabbage aphids.

**Keywords:** *Brevicoryne brassicae*, Cabbage, Infestation, Mortality, Insecticide, Yield.

**HOW TO CITE THIS ARTICLE:** Shiberu T. Efficacy of New Chemical Insecticides against Cabbage Aphids, *Brevicoryne brassicae* L. (Aphididae: Homoptera) in West Shoa of Ethiopia. Entomol Appl Sci Lett. 2024;11(4):9-15. https://doi.org/10.51847/J7cXFibKG8

**Corresponding author:** Tadele Shiberu
**E-mail** ✉ s1978tade@gmail.com
**Received:** 17/07/2024
**Accepted:** 29/11/2024

## INTRODUCTION

Cabbage (*Brassica oleracea* var. capitata Linnaeus), production is expanding in Ethiopia along with the improvement of awareness towards the use of irrigation as well as potential market value of this crop. Cabbage is an essential leafy plant grown annually mainly for use as a vegetable crop [1, 2].

Despite cabbage's many advantages, insect pest attacks limit its production, resulting in a sharp decline in yield and quality that lowers its market value and discourages farmers from growing it. Diseases and insect pests are the two main production restrictions that lower the quality and marketable output of cabbage [3].

The Cabbage aphid, *Brevicoryne brassicae* is one of the most important insect pests in cabbage-growing areas of the world. In Ethiopia, it affects cabbage yield by direct feeding as well as reducing the quality of cabbage. Feeding during the vegetative stages can reduce plant vigor and growth and result in severe yield losses. Heavy infestations during heading can also cause quality and quantity reductions [4]. They can reduce plant growth by 35-75%, causing devastating damages and sometimes total crop loss on brassicae leafy vegetables [5].

Various management options for the control of cabbage aphids were suggested by concerned researchers and scientists. These management options have been practiced in different areas and years. Damage and impact of damage on

yield depend on the cabbage variety grown and other elements of the ecosystems like natural enemies and weather conditions, fertilizer, and water availability [6]. Due to those constraints, the control and management of the cabbage insect pests and diseases is very poor in most African smallholder farmers [7]. Hence, the study of this experiment of to determine the rate of insecticides and evaluate the new insecticides against cabbage aphids under field conditions.

## MATERIALS AND METHODS

*Description of the study area*

Three distinct sites in the West Shoa Zone of Oromia Regional State, Ethiopia Ambo, Toke Kutaye, and Ejersa Lafo districts were used for the field experiment in irrigation water during the dry season. Between 1900 and 3100 meters above sea level, the research areas are located in N 08º 43.423-N 10º 12.082 and E 037º 28.902-040º 62.590. With a total land area of 78887 square kilometers, Toke Kutaye and Ambo district is situated at latitude 8o 57' North and longitude 38o 07' East, with an average elevation of 1800-2300 meters above sea level. Ejersa Lafo district is located 70 km west of Addis Ababa, Ethiopia's capital, and spans a latitude range of 900′0′′ to 90 50′0′′N and a longitude range of 380 12′30′′ to 380 17′30′′E.

*Treatments and experimental design*

The field experiment was conducted to evaluate new insecticides for the control of Cabbage aphid and their impact on yield and yield component of the crop during the crop season 2021 using the 'Copenhagen' variety of cabbage. The plant was planted in 1st week of January 2021. The experiment was carried out in a Randomized Complete Block Design with eight treatments including standard and control checks with three replications.

Every week, the field experiment was inspected for indications of cabbage damage and occurrence until aphid infestation of the leaves occurred. After treatment application, the population number of aphid counts was made every week till the second spray was undertaken. The experimental plot consisted of an area 4 m long and 3 m wide, with a plot area of 12 $m^2$. The application was conducted when Cabbage aphid infestation reached an economic threshold level of 20% infestation observed in all plots. Treatments are listed below in **Table 1**.



**Table 1.** List of treatments

| Treatments | Common name | Rate (ml/ha) |
|---|---|---|
| Dedustar 35% SC (T1) | Imidacloprid | 175 |
| Dedustar 35% SC (T2) | | 200 |
| Dedustar 35% SC (T3) | | 225 |
| Range 5% EC (T4) | Lambda-Cyhalothrin 50 EC | 300 |
| Range 5% EC (T5) | | 325 |
| Range 5% EC (T6) | | 375 |
| Closer 240 SC (T7) | Sulfoxaflor | 300 |
| Control (Untreated) (T8) | | |

## RESULTS AND DISCUSSION

*Effect of synthetic insecticides on mortality of cabbage aphids*

Cabbage aphids were mostly variable from district to district and field to field. The application of both new insecticides at all rates significantly influenced the population of cabbage aphids in all districts. The percent mortality range was 72.95(58.66), 75.33(58.26), and 71.58(57.78) in Ambo, Toke kutaye and Ejersa lafo at minimum rate, respectively. **Table 2** shows the percent mortality of cabbage aphids in three districts of West Shoa. The present study revealed that Dedu star 35% SC at maximum rate gave 97.84 (81.90) followed by Range 5% EC 90.81 (72.42). There was no significant ($P \geq 0.05$) difference from the previously registered insecticides Closer 240 SC recorded 95.73 (78.08). However, significantly ($P \leq 0.05$) different from untreated control, it was recorded increasing the population number of cabbage aphids whereas the sprayed plots highly reduced the population of aphids **(Table 2)**.

**Table 2.** Percent mortality of different insecticides at different rates against Cabbage aphids, *Brevicoryne brassicae* (L.) after treatment exposure of 48 hours.

| Treatment | Rate ml/ha | Percent Mortality after 48 h | | | |
|---|---|---|---|---|---|
| | | Ambo | Toke kutaye | Ejersa lafo | Mean |
| Dedu star 35% SC (Imidacloprid) | 175 | 72.95(58.66)±1.02$^{c}$ | 75.33(58.26)±1.02$^{c}$ | 71.58(57.78)±1.01$^{c}$ | 73.29 (58.23)$^{c}$ |
| | 200 | 83.58(66.09)±1.15$^{b}$ | 88.25(69.95)±1.22$^{b}$ | 84.33(66.68)±1.16$^{b}$ | 85.39 (67.57)$^{b}$ |
| | 225 | 96.13(78.65)±1.37$^{a}$ | 99.13(84.65)±1.48$^{a}$ | 98.25(82.40)±1.44$^{a}$ | 97.84 (81.90)$^{a}$ |
| Range 5% EC (Lambda-Cyhalothrin 50 EC) | 325 | 63.36(52.75)$^{d}$±0.92 | 72.67(58.48)c±1.02 | 67.33(55.14)$^{c}$±0.96 | 67.79 (55.46)$^{c}$ |
| | 350 | 76.48(60.99)$^{c}$±1.06 | 80.81(63.66)$^{bc}$±1.11 | 78.35(62.27)$^{b}$±1.09 | 78.55 (62.31)$^{b}$ |
| | 375 | 88.52(70.19)$^{b}$±1.22 | 92.57(74.18)$^{ab}$±1.29 | 91.33(72.88)$^{a}$±1.27 | 90.81 (72.42)$^{ab}$ |
| Closer 240 SC (Sulfoxaflor) | | 95.39(77.60)$^{a}$±1.35 | 96.13(78.65)$^{a}$±1.37 | 95.67(77.99)$^{a}$±1.36 | 95.73 (78.08)$^{a}$ |
| Untreated control | | 6.33(14.57)$^{e}$±0.25 | 11.07(19.44)$^{d}$±0.34 | 8.15(16.59)$^{d}$±0.29 | 8.52 (16.87)$^{d}$ |

**Note:** Means with the same letter(s) in the same columns are not significantly different from each other.
All treatment effects were significant at p<0.05 (DMRT).

*Population buildup of cabbage aphids after first and second spray*

The data presented in **(Table 3)** showed that the pre-treatment count of cabbage aphids average in the three districts were 27.05, 15.45, 21.13, 18.33, 26.13, 14.75, 23.67, 20.33 per cabbage head were determined for T1, T2, T3, T4, T5, T6, T7, and T8. After the first spray, the average population buildup of cabbage aphids was recorded as an average of three districts after the first spray of 15 days 8.60, 8.28, 13.22, 10.16, 12.16, 7.15, and 104.25, respectively. **Table 3** shows that a high population buildup was recorded in Ambo followed by Toke kutaye, however relatively low population buildup was recorded in Ejersa lafo. This indicated that Cabbage aphids were mostly variable infestation levels from district to district and field to field. Analysis of variance showed significant differences between time intervals and locations. In the second-round spray after the second spray of 15 days in all three districts the population infestation level was highly reduced and almost none in some treatments at the maximum level rate of both insecticides. In Toke kutaye and Ejersa lafo, the insect pest infestation tends to decline after 30 days of the first and 15 days of the second treatment application. The pattern of infestation of untreated plots in all districts was simultaneously increased day after day. However, in Ambo high population build up recorded followed by Toke kutaye and Ejersalafo, 170.33, 127.13, and 110.02, respectively **(Table 4)**.



**Table 3.** Infestation level of cabbage aphids after the first spray of 15 days per plant

| Treatment | Rate ml/ha | No. of aphids infestation per plant | | | |
|---|---|---|---|---|---|
| | | Ambo | T/ kutaye | Ejersa lafo | Mean |
| Dedustar 35% SC (Imidacloprid) | 175 | 12.42$^{d}$ | 9.25$^{c}$ | 4.13$^{bc}$ | 8.60 |
| | 200 | 17.52$^{c}$ | 7.33$^{c}$ | 0.00$^{c}$ | 8.28 |
| | 225 | 22.17$^{b}$ | 17.49$^{b}$ | 0.00$^{c}$ | 13.22 |
| Range 5% EC (Lambda-Cyhalothrin 50 EC) | 325 | 16.33$^{c}$ | 3.22$^{cd}$ | 0.22$^{c}$ | 6.59 |
| | 350 | 19.22$^{cb}$ | 5.14$^{c}$ | 6.12$^{b}$ | 10.16 |
| | 375 | 26.40$^{b}$ | 0.00$^{d}$ | 10.07$^{b}$ | 12.16 |
| Closer 240 SC (Sulfoxaflor) | 300 | 17.22$^{c}$ | 4.22$^{cd}$ | 0.00$^{c}$ | 7.15 |
| Untreated control | | 143.25$^{a}$ | 107.28$^{a}$ | 62.25$^{a}$ | 104.25 |
| LSD at 0.05 | | 4.52 | 5.02 | 3.97 | |
| SE± | | 2.55 | 1.27 | 0.57 | |
| CV (%) | | 16.35 | 14.22 | 15.64 | |

**Note:** Means with the same letter(s) in the same columns are not significantly different from each other.
All treatment effects were significant at p<0.05 (DMRT).

**Table 4.** Infestation level of cabbage aphids after the second spray of 15 days per plant

| Treatment | Rate ml/ha | No. of aphids infestation per plant | | |
|---|---|---|---|---|
| | | Ambo | T/ kutaye | Ejersa lafo |
| Dedustar 35% SC | 175 | 2.13[a] | 0.67[a] | 0.00[a] |
| | 200 | 6.22[a] | 2.33[a] | 0.00[a] |
| | 225 | 0.00[a] | 0.00[a] | 0.00[a] |
| Range 5% EC | 325 | 7.22[b] | 0.00[a] | 0.00[a] |
| | 350 | 0.00[a] | 0.00[a] | 0.00[a] |
| | 375 | 0.00[a] | 0.00[a] | 0.00[a] |
| Closer 240 SC Untreated control | 300 | 3.67[a]<br>170.33[c] | 0.00[a]<br>127.13[b] | 0.00[a]<br>110.02[b] |

**Note:** Means with the same letter(s) in the same columns are not significantly different from each other.
All treatment effects were significant at p<0.05 (DMRT).

Results show in **Figure 1** no significant (P>0.05) difference among the treatments except the untreated one. However, a significant difference was observed between treated and untreated treatments. The maximum weight per plant was recorded at 1.64 kg/plant in the standard check (Closer 240 SC) followed by Dedustar 35% SC at a maximum rate of 1.60 kg/plant.

Concerning, the diameter of the cabbage head in all treatments no significant difference was observed. However, significant differences were recorded between treated and untreated controls **(Table 5)**.

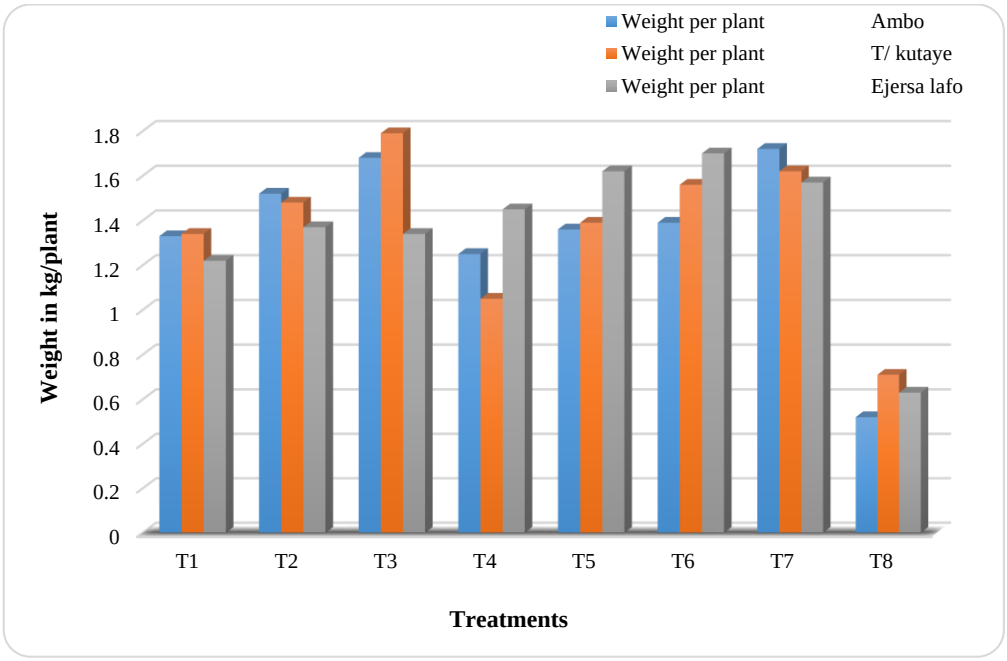


**Figure 1.** Weight of Cabbage head per plant in kg
**Note:** T1= Dedustar 35% SC, T2= Dedustar 35% SC T3= Dedustar 35% SC, T4= Range 5% EC, T5= Range 5% EC, T6= Range 5% EC, T7= Closer 240 SC, and T8= untreated control

**Table 5.** Effect of insecticides on the size of cabbage head diameter per plant in cm

| Treatment | Rate ml/ha | Head diameter in cm per plant | | |
|---|---|---|---|---|
| | | Ambo | T/ kutaye | Ejersa lafo |
| Dedustar 35% SC (Imidacloprid) | 175 | 14.22[a] | 14.75[a] | 14.33[a] |
| | 200 | 13.69[a] | 14.66[a] | 14.92[a] |
| | 225 | 13.78[a] | 14.25[a] | 15.13[a] |
| Range 5% EC | 325 | 14.67[a] | 13.57[a] | 14.56[a] |

| | | | | |
|---|---|---|---|---|
| (Lambda-Cyhalotthrin 50 EC) | 350 | 14.28[a] | 14.15[a] | 14.28[a] |
| | 375 | 14.59[a] | 14.37[a] | 14.67[a] |
| Closer 240 SC (Sulfoxaflor) | 300 | 14.49[a] | 14.44[a] | 14.87[a] |
| Untreated control | | 7.13[b] | 6.58[b] | 7.28[b] |

**Note:** Means with the same letter(s) in the same columns are not significantly different from each other.
All treatment effects were significant at p<0.05 (DMRT).

*Weight of Cabbage head and its yield loss*

The cabbage head yield observed in all locations was a significant (P < 0.05) difference between the treated and untreated treatments. While there is no significant (P > 0.05) difference between the new insecticide and the previously registered insecticide (Closer 240 SC) in **Figure 2**.

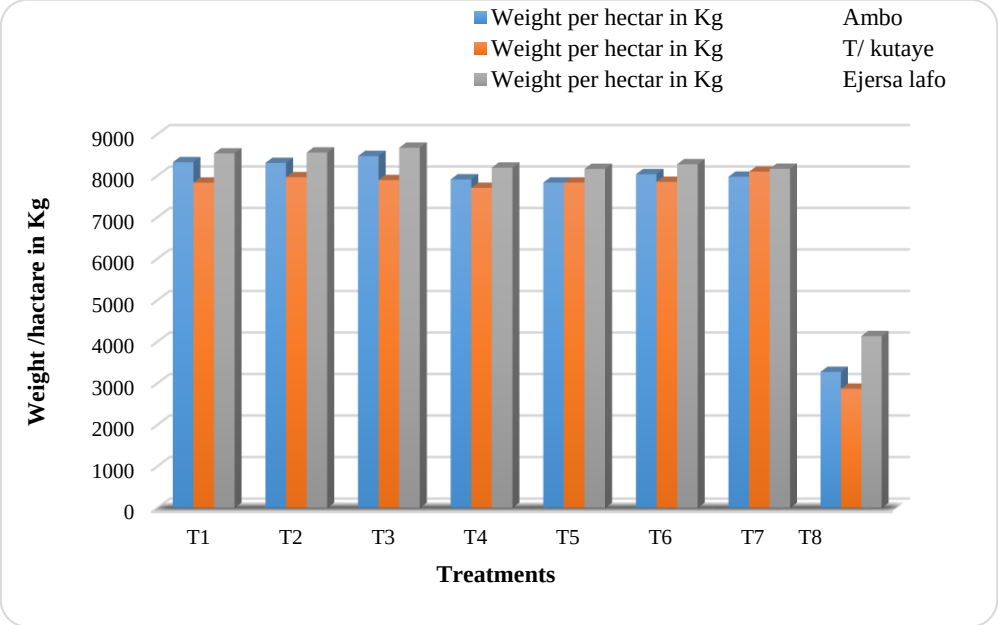


**Figure 2.** Weight of Cabbage head per hectare in kg

The untreated control of Cabbage head was highly infested in aphids at different locations of the study areas. The results in **(Table 6)** revealed that a significant (P < 0.05) difference in percent yield loss of cabbage heads was observed in untread treatments 61.37%, 64.01%, and 52.32% in Ambo, Toke kutaye, and Ejersa Lafo, respectively. The mean lowest yield loss showed in treatments of Dedustar 35% SC (Imidacloprid) in all rates followed by Closer 240 SC, and Range 5% EC (Lambda-Cyhalotthrin 50 EC) at a maximum rate.

**Table 6.** Yield loss due to cabbage aphids on Cabbage head in Percent

| Treatment | Rate ml/ha | Yield loss | | | |
|---|---|---|---|---|---|
| | | Ambo | T/ kutaye | Ejersa lafo | Mean |
| Dedustar 35% SC (Imidacloprid) | 175 | 1.77[c] | 1.64[b] | 1.58[c] | 1.67[c] |
| | 200 | 1.95[c] | 0.88[b] | 1.34[c] | 1.39[c] |
| | 225 | … | … | … | … |
| Range 5% EC (Lambda-Cyhalotthrin 50 EC) | 325 | 6.64[b] | 3.33[b] | 5.53[b] | 5.17[b] |
| | 350 | 7.55[b] | 1.63[b] | 5.88[b] | 5.02[b] |
| | 375 | 5.19[b] | 1.41[b] | 4.60[b] | 3.73[c] |
| Closer 240 SC (Sulfoxaflor) | 300 | 5.88[b] | 0.19[b] | 1.23[c] | 2.43[c] |
| Untreated control | | 61.37[a] | 64.01[a] | 52.32[a] | 59.23[a] |

**Note:** Means with the same letter(s) in the same columns are not significantly different from each other.
All treatment effects were significant at p<0.05 (DMRT).

The result was consistence with the work of Hira *et al*. [8] who reported that imidacloprid concentration was recorded 24 hours after its spray in aphid mortality followed by a highly significant effect recorded after 48 hours. The findings of the current study are confirmed with the work of Faheem *et al.* [9] who reported that imidacloprid was the most effective treatment against cabbage aphid on round-head cabbage. Similarly, Debbarma and Kumar [10] described that imidacloprid was found to be effective against *B. brassicae*. The study conducted by Sahoo [11] in West Bengal reported that imidacloprid and Thiamethoxam were found the most effective against mustard aphids under field conditions. A similar result was reported by Ermias and Emana [12] they reported that imidacloprid was highly effective for the management of cabbage aphids and gave 82.84% percent mortality of cabbage aphids.

In the present study, it was found that imidacloprid showed more than 96.13% mortality during an exposure period of 48 hours at the maximum concentration at all locations, it was also supported by Mustafa's [13] findings, who reported imidacloprid was the most effective with 92.28 % mortality after 72 hours of post-treatment. In addition, it is also confirmed by Muhammad *et al.* [14] who reported that imidacloprid belongs to the same chemical group with the same mode of action and shown a better percent mortality against cabbage aphids.

The finding was not consistence with Sinha *et al.* [15] and Devi *et al*. [16] results that spray different insecticides for the management of aphids. Different insecticides belong to organochlorides [17, 18] and organophosphates have been used to control aphids on Brassica but most of them were associated with undesirable traits such as failure in controlling aphid attack or persistence in the environment and resistance development by the aphid.

## CONCLUSION

In all locations, the percent mortality of treatment insecticides was found to be analogous and active in the management of cabbage aphids' populations under open field conditions. They can be used to avoid the hazard of a delayed spray, minimize early cabbage aphid infestation, and maximize cabbage head yield. Based on these studies it will be recommended to use as a foliar spray of insecticides to give suitable and reliable control of *Brevicoryne brassicae* in different ecologies of Ethiopia.

**ACKNOWLEDGMENTS:** None

**CONFLICT OF INTEREST:** None

**FINANCIAL SUPPORT:** None

**ETHICS STATEMENT:** None

## REFERENCES

1. Baidoo PK, Mochiah MB. Comparing the effectiveness of garlic (Allium sativum L.) and hot pepper (Capsicum frutescens L.) in the management of the major pests of cabbage brassica oleracea (L.). Sustain Agric Res. 2016;5(2):83-91.
2. Gyanoba MS. Bio-efficacy of newer insecticides against Diamondback moth (Plutella xylostella L.) and their residues in cabbage. Mahatma Phule Krishi Vidyapeeth Rahuri: Maharashtra, India. 2018.
3. Hefner M, Gebremikael MT, Canali S, Serra FXS, Petersen KK, Sorensen JN, et al. Cover crop composition mediates the constraints and benefits of roller-crimping and incorporation in organic white cabbage production. Agric Ecosyst Environ. 2020;296:106908.
4. Anderson W, Impiglia A. Bread wheat: Improvement and production. Food and Agriculture Organization of the United Nations; 2002. p. 407-32.
5. Sharma N, Singhvi R. Effects of chemical fertilizers and pesticides on human health and environment: A review. Int J Agric Environ Biotechnol. 2017;10(6):675-9.
6. Ezena GN, Akotsen HC, Fening KO. Exploiting the insecticidal potential of the invasive siam weed, chromolaena odoratal (Asteraceae) in the management of the major pests of cabbage and their natural enemies in southern Ghana. Adv Crop Sci Technol. 2016;4(4).
7. Okolle NJ, Afari-Sefa V, Bidogeza JC, Tata PI, Ngome FA. An evaluation of smallholder farmers' knowledge, perceptions, choices, and gender perspective in vegetable pests and disease control practices in the humid

tropics of Cameroon. Int J Pest Manag. 2016;62(3):165-74.
8. Hira H, Ali H, Ihsan A, Akhtar ZR, Ameer S, Yasin M, et al. Comparative efficacy of insecticides against cabbage aphid brevicoryne brassicae, a pest of oilseed rape, brassica napus (L.) under controlled conditions. J Bioresour Manag. 2022;9(2):8.
9. Faheem M, Muhammad A, Farzana P, Nikhat Y, Muhammad F. Comparative management of cabbage aphid (Myzus persicae (Sulzer) through bio- and synthetic – insecticides. Pak Entomol. 2010;32(1):12-7.
10. Debbarma H, Kuma, V. Efficacy of insecticides and botanicals against brevicoryne brassicae population on cabbage. J Bio Innov. 2020;9(3):314-22.
11. Sahoo S. Incidence and management of mustard aphid (Lipaphis erysimi K.) in West Bengal. J Plant Prot Sci. 2012;4(1):20-6.
12. Ermias S, Emana G. Efficacy of plant-derived and synthetic insecticides against Cabbage aphid, Brevicoryne brassicae (L.) (Homoptera: Aphididae) and their effect on coccinellid predators. SINET: Ethiop J Sci. 2021;44(1):27-37.
13. Mustafa G. Efficacy of different insecticides against Lipaphis erysimi on Canola. Annual Report, AARI. 2000:81-2.
14. Muhammad A, Munir A. Effectiveness of some insecticides against cabbage aphids, Brevicoryne brassicae (Linnaeus) (Aphididae: Homoptera). J Res. (Science). 2002;13(2):145-50.
15. Sinha RP, Kumari K, Singh SN. Relative efficacy and persistent toxicity of insecticides against mustard aphid. Indian J Entomol. 2001;63(2):186-91.
16. Devi N, Dogra I, Raj D. Comparative efficacy of insecticides against mustard aphid. Lipaphis erysimi (Kalt.) on rapeseed crop in mid-hill zone of Himachal Pradesh. J Entomol Res. 2001;25(2):93-6.
17. Nawaz A, Ali H, Sufyan M, Gogi MD, Arif MJ, Ali A, et al. In-vitro assessment of food consumption, utilization indices, and losses promises of leafworm, Spodoptera litura (Fab.), on okra crop. J Asia-Pacific Entomol. 2020;23(1):60-6.
18. Fiaz S, Wang X, Younas A, Alharthi B, Riaz A, Ali H. Apomixis and strategies to induce apomixis to preserve hybrid vigor for multiple generations. GM Crops Food. 2021;12(1):57-70.